

OPERATING NOTES AND INSTRUCTIONS
FOR THE
IN-1 AUDIO OSCILLATOR

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subjected to individual systematic review.

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I. GENERAL DESCRIPTION

The Model IN-1 Audio Oscillator is a self-contained battery-operated audio oscillator supplying a pulse output wave of 30 to 3000 cps in two bands. This instrument was designed to occupy the smallest possible volume and still meet the necessary functional and frequency stability requirements. The dial does not indicate frequency directly but covers a numerical range of 000 to 999. A calibration curve for each unit must be used to obtain the actual frequency.

Two output jacks are provided so that an ear piece and a recorder can be used at the same time.

II. CHARACTERISTICS

2.1. Electrical

Nominal Frequency Range: Band A - 30 to 300 cps

Band B - 300 to 3000 cps

Frequency Stability : Better than plus or minus 2 per cent
over the temperature range of minus 40
to plus 55 degrees Centigrade and a
supply voltage variation of 15 to 30
volts.

Output Waveform : Pulse

Warmup Time : None

Power Source : Self-contained 22.5 volt battery.
Eveready type 412E or Burgess type U15.
The current required will vary between
units but should be no greater than 3
milliamperes at 22.5 volts.

Load Impedance : The load should be 1000 ohms or higher.

Output Voltage : Continuously variable. The maximum peak
pulse voltage will be approximately equal
to the power supply voltage.

Headphone Impedance : 2000 ohms

2.2. Physical

Weight : 16 ounces

Dimensions: 5" x 2-7/8" x 1-3/16" over-all

III. OPERATING INSTRUCTIONS

3.1. Controls and Terminals (See Figure 1)

- OFF : This is a switch fastened to the AMPLITUDE control and connects the battery to the KEY button. This switch is connected in series with the KEY button and prevents the battery from being discharged if the KEY button is accidentally pressed while the instrument is being carried or stored.
- RANGE : This switch changes the capacity values in the frequency determining circuit of the instrument. The position of this switch determines the frequency range covered. Position "A" covers the range 30 to 300 cps and position "B" covers the range 300 to 3000 cps.
- AMPLITUDE : This control varies the magnitude of the signal voltage applied to the OUTPUT jacks.
- COUNTER : This is a dial with a numerical range of 000 to 999. If the RANGE switch position is known the actual frequency can be obtained from the "Frequency Dial Reading" curve supplied with the instrument (See Figure 6).
- FREQUENCY : This control varies the frequency of the instrument. The knurled portion of the knob may be used for fine frequency adjustment and the bar on the

face of the knob may be used for rapid frequency changes.

OUTPUT : The output pulse signal appears at these jacks.

KEY : This button connects the battery to the oscillator. The AMPLITUDE control must be turned on before the KEY button will function. Pressing this button causes the signal to appear on the OUTPUT jacks.

COVER RETAINER: This screw is used to remove the cover when replacing the battery.

3.2. Operation of the Instrument

The procedure for the correct operation of this oscillator is as follows:

- a. Loosen COVER RETAINER screw on the end of the case. This screw may be turned with a coin.
- b. Remove the cover and place an Eveready 412E or Burgess U15 22.5 volt battery in the battery holder. The correct battery polarity is marked on the side of the battery holder.
- c. Replace the cover and tighten the COVER RETAINER screw.
- d. Rotate the AMPLITUDE control 270 degrees clockwise. This connects the battery to the KEY button and at the same time places the maximum signal voltage amplitude across the OUTPUT jacks when the KEY button is pressed.

- e. Place the ear piece in one of the two OUTPUT jacks.
- f. Press the KEY button and a signal should be heard in the ear piece.
- g. Set the AMPLITUDE control so the instrument is delivering the desired amplitude to the ear piece and/or recorder.
- h. Set the FREQUENCY control and RANGE switch to the desired frequency.

3.3. Power Supply

Type: Eveready 412E or Burgess U15, 22.5 volts.

Life: Power is required only during the time that the KEY button is pressed. Under these conditions the battery will have exceptionally long life. The battery should last at least 25 hours under continuous operation. To determine whether the battery should be replaced, adjust the frequency of oscillation to 3000 cps. Listen to the ear piece and if a frequency change can be detected by the ear when the KEY button is depressed then the battery should be replaced.

IV. CIRCUIT DESCRIPTION

The circuit is composed of a unijunction transistor relaxation type oscillator followed by a transistor grounded collector amplifier to isolate the load from the oscillator.

The frequency of oscillation is generally determined by the time required to charge C1 or C2 to the "breakdown" potential of the unijunction transistor. These capacitors are charged by the battery through the parallel paths provided by the external resistances R1, R2, and R3, and the back resistance of the transistor P-N junction. When the potential across C1 or C2 reaches the "breakdown" value the forward resistance of the unijunction transistor junction reduces to a very low value and discharges the condenser. The condenser then charges again and the cycle is repeated. The variable resistance R3 has very little to do with the actual frequency but is necessary in order that the oscillator may be stabilized with temperature and supply voltage variations. The value of R3 was determined at the time the unit was constructed and should be changed only if the unijunction transistor must be replaced.

V. MAINTENANCE

The only maintenance required in the field is the periodic replacement of the battery.

Since the accuracy of the oscillator depends upon the unijunction transistor and the setting of R3, the most difficult repair problem is the replacement of the unijunction transistor. Replacement of the unijunction transistor must be accompanied by a resetting of R3. This is done in the following manner:

- a. Remove the internal battery and connect a variable voltage supply to the proper terminals of the REMOTE socket. This supply should have a continuously variable voltage range of at least 15 to 30 volts.
- b. Connect the OUTPUT to the Y-axis of an oscilloscope and an audio signal generator to the X-axis of the oscilloscope.
- c. Adjust the frequency of the audio signal generator to that of the reference oscillator.
- d. Set R3 to minimum resistance.
- e. Vary the applied voltage from 15 to 30 volts and note how much change occurs in the frequency of the reference oscillator. If the frequency changes more than one or two cycles per second R3 should be increased slightly and the voltage

changed from 15 to 30 volts again. Find the value of R_3 which maintains the frequency of the oscillator essentially constant with changes in supply voltage. In some cases it may be found that the value of R_3 for minimum frequency change may be zero but there should never be a case where the required resistance is greater than 500 ohms, the maximum value of the potentiometer.

COMPONENT LIST

<u>Component</u>	<u>Value or Type</u>	<u>Manufacturer</u>
B ₁ Battery	22.5 volts	Eveready 412E or Burgess U15
C1 Capacitor	*.01 uf silver mica Type MS 11	Sprague
C2 "	*0.1 uf precision	Sprague "Styracon"
C3 "	1.2 uf, 30V DC, Tantalum	Fansteel STA 170
J1, J2 Jack	Type 9220	Telex
R1 Resistor	51,000 ohm, 5% $\frac{1}{2}$ watt	Allen-Bradley
R2 "	500,000 ohm, 10 turn, variable wire-wound, Type 920	Fairchild
R3 "	500 ohm, variable, wire- wound, Model 300-00	Daystrom-Pacific
R4 "	Variable composition with switch, Model 1 Radiohm	Centralab
S1 Switch	Push Button, SPST, Series #30	Grayhill
S2 "	SPST ganged with R4	
S3 "	SPDT, Type T3103	Hetherington
T1 Transformer	600 ohm to 3.2 ohm	UTC Dot 4
TR1 Transistor	Unijunction 4JX5A513 743 (ZJ14)	G.E.
TR2 "	NPN Type 2N35	Sylvania

* This is nominal value and may vary between units.

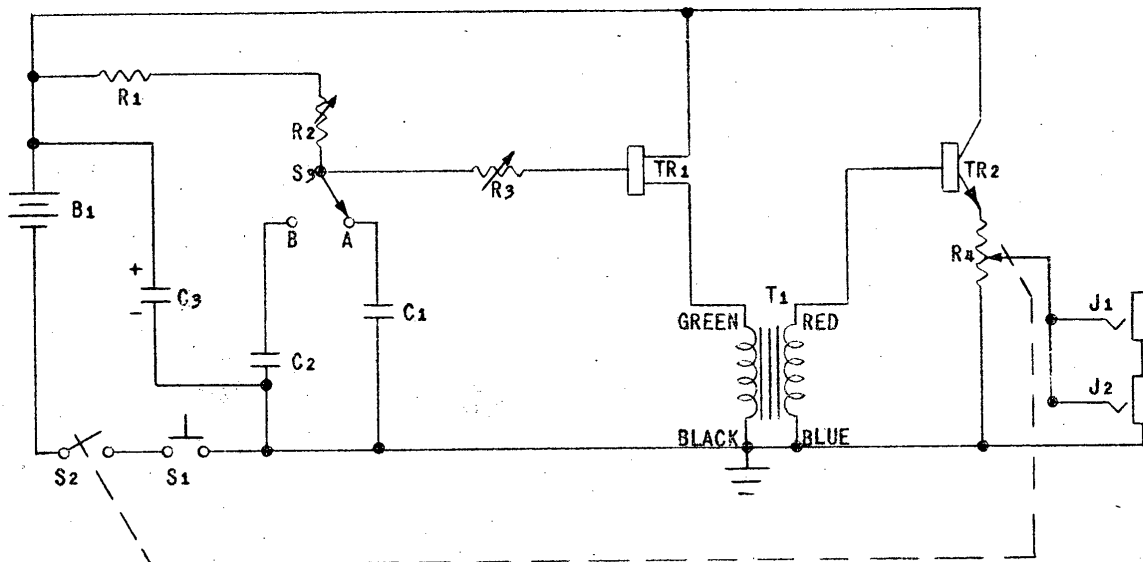


FIGURE 5

IN-1 SCHEMATIC	
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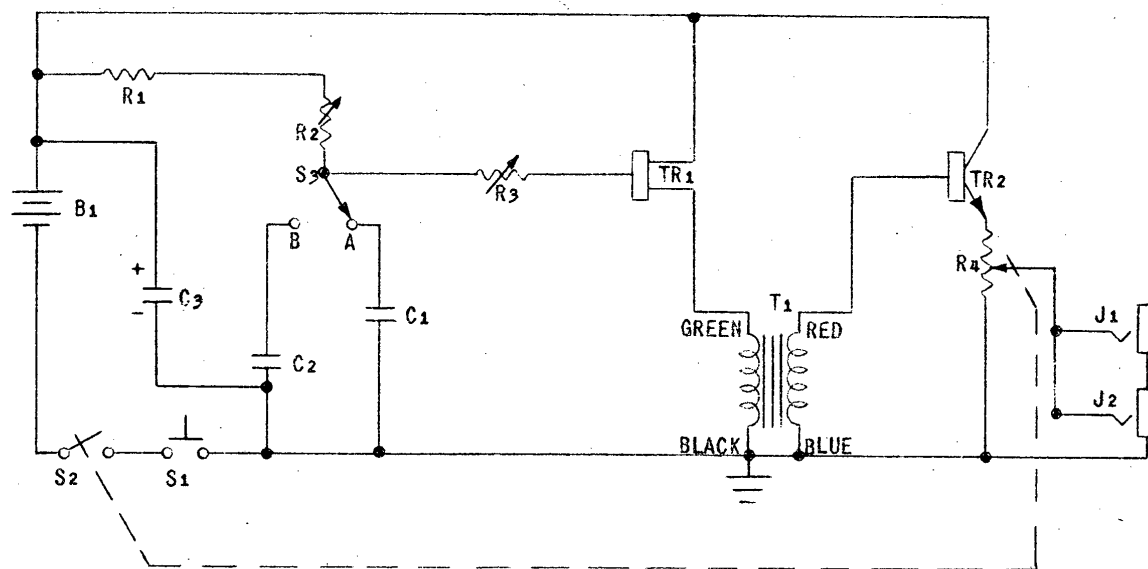


FIGURE 5

IN-1
SCHEMATIC

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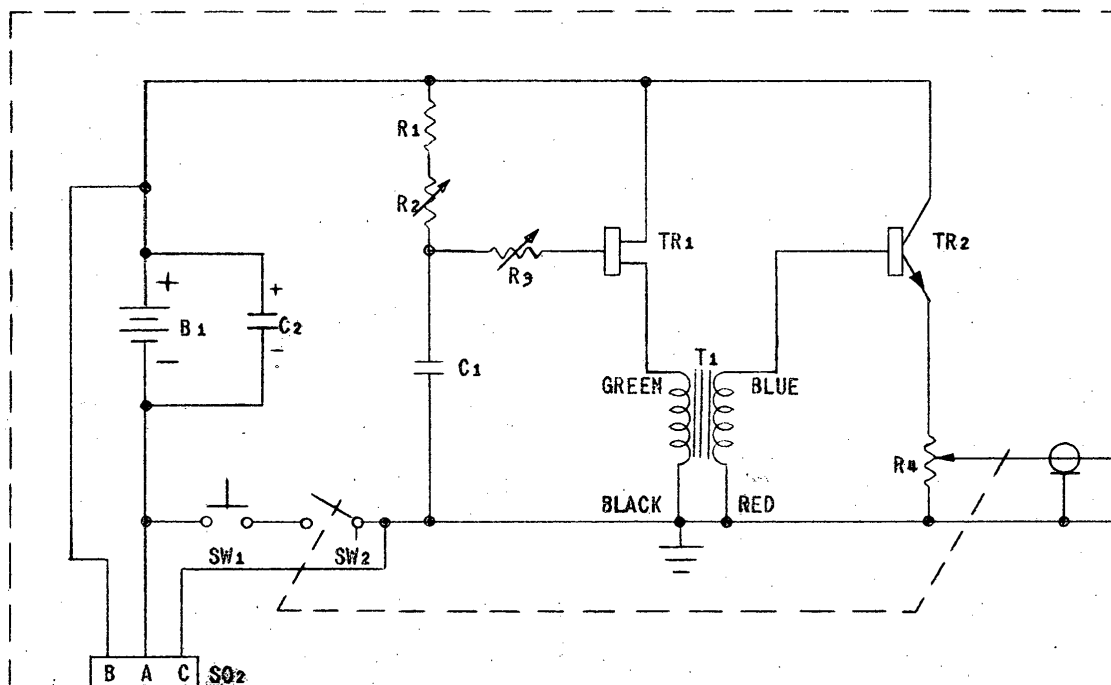
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FIGURE 4

1000 CPS
FIXED FREQUENCY
REFERENCE OSCILLATOR

DRAWN BY: *ELAN*

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